

Tools to Support Human Centered Design

James A. Pharmer

Gwendolyn Campbell, Ph.D.

Naval Air Warfare Center Training Systems Division

Patricia Hamburger

Naval Surface Warfare Center Dahlgren Division



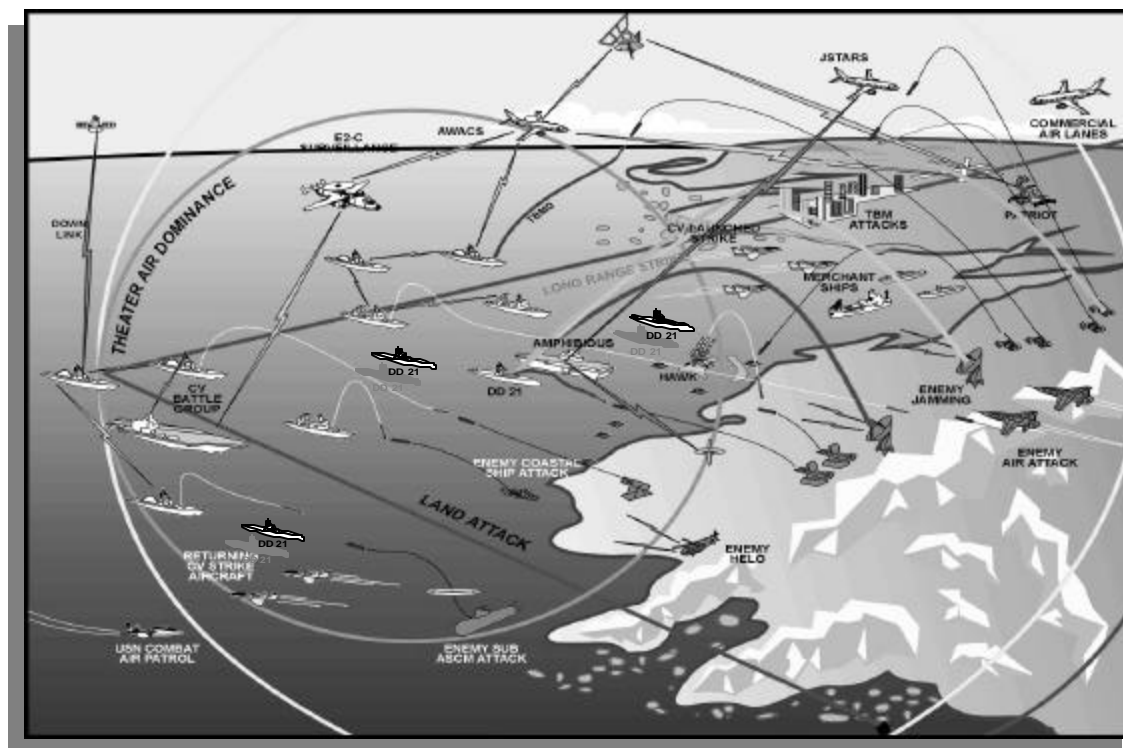
Proceedings Magazine, April 1999

"Throwing people at a real or perceived problem no longer is a reasonable solution. What was once cheap and easy no longer is applicable, affordable, or desirable."



The Challenge

- Extensive Land Attack Capability
- Multi - Warfare Defense
- Common Tactical Picture for Battlegroup and Expeditionary Force
- Network - Centric Warfare

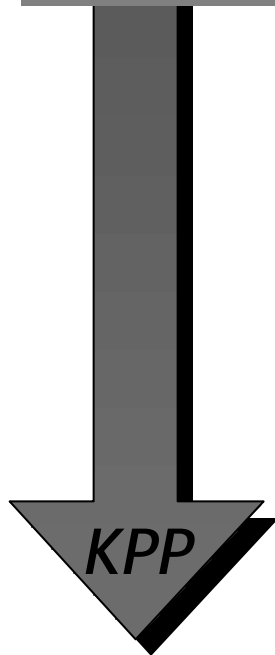


*Optimal
Manning*



DD 21 Manning Challenge

*Traditional
Manning 440*



*DD 21
Objective
95 People*

- Total paradigm shift
 - Crew mix, skills and rating structures
 - Watchstanding requirements
 - Career paths
 - Training
- To ensure
 - Full mission capability
 - Affordability
 - Quality of Life

*DD 21 must be
designed for the Sailor*

Reduced Manning¹ Greater Workload



S&T Initiative Goal

Demonstrate how
human-centered design technologies
enable a
2-to-1 manning reduction in
combat information center systems
with optimal performance.



S&T Approach & Research Teams

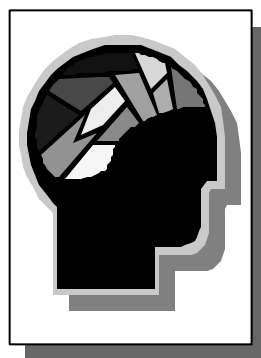
Thrust 1

Dr. Jan Cannon-Bowers

Human Performance

Models & Metrics

(Individual/Team/Organizational)

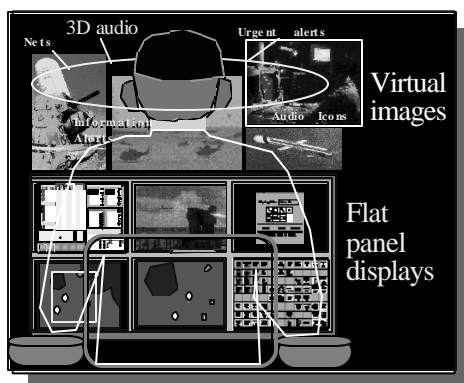


Thrust 2

Dr. Glenn Osga

Multi Modal

Watchstation



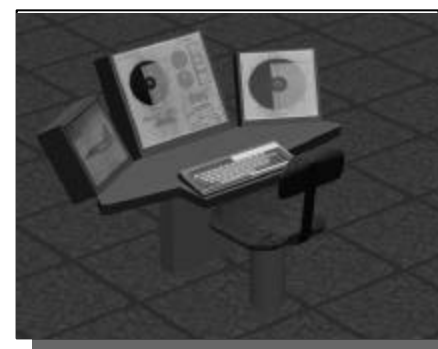
Watchstation Requirements
Advanced HCI Guidelines
Prototype MMWS

Thrust 3

Dr. Harry Crisp

Human Centered

Design Tools

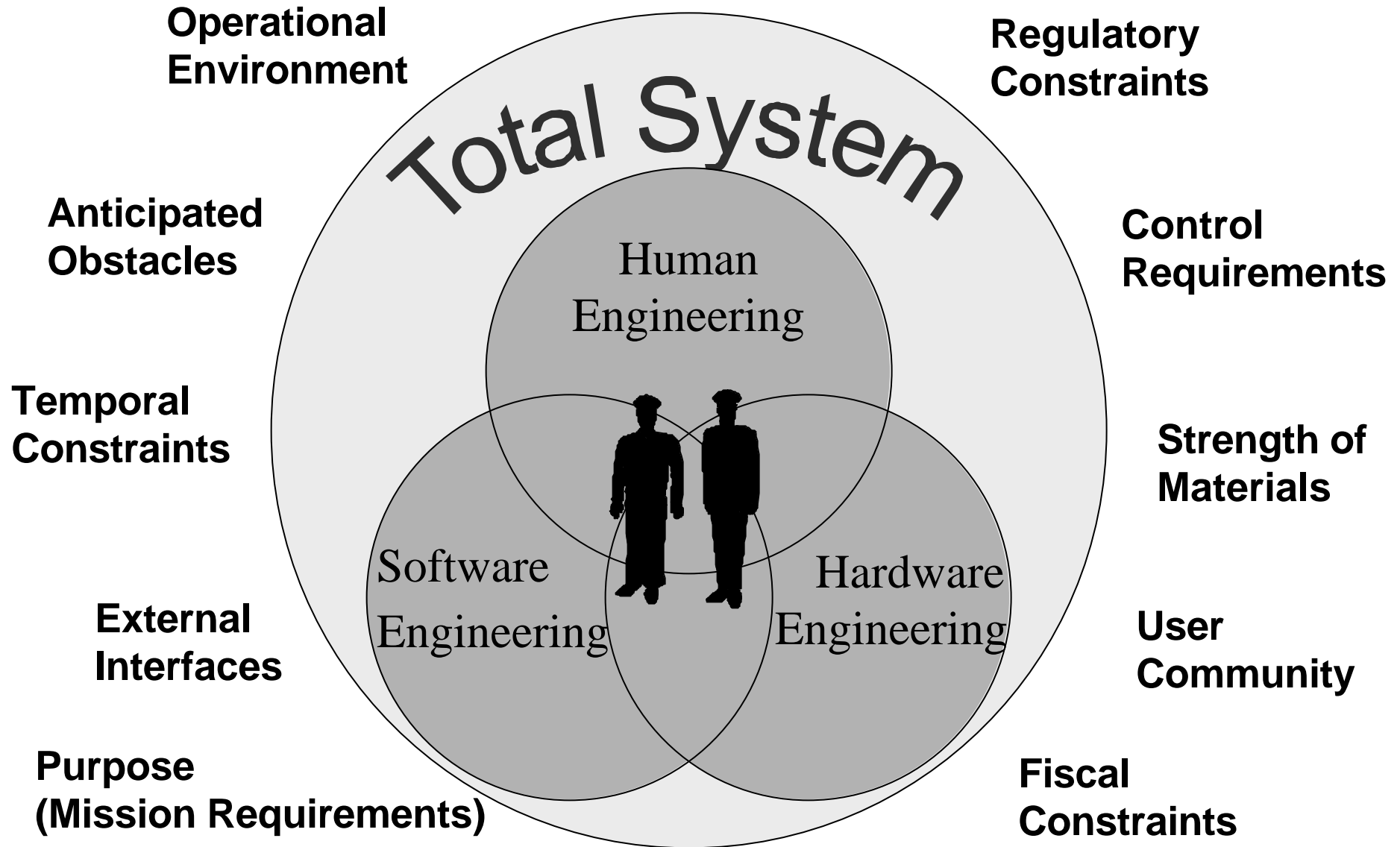


Tool Set, Process, & Methodology for
Complex System Design
Ensuring Human Aspects Considered
Throughout Design





Total Systems Engineering





To Engineer the *Total* System ...

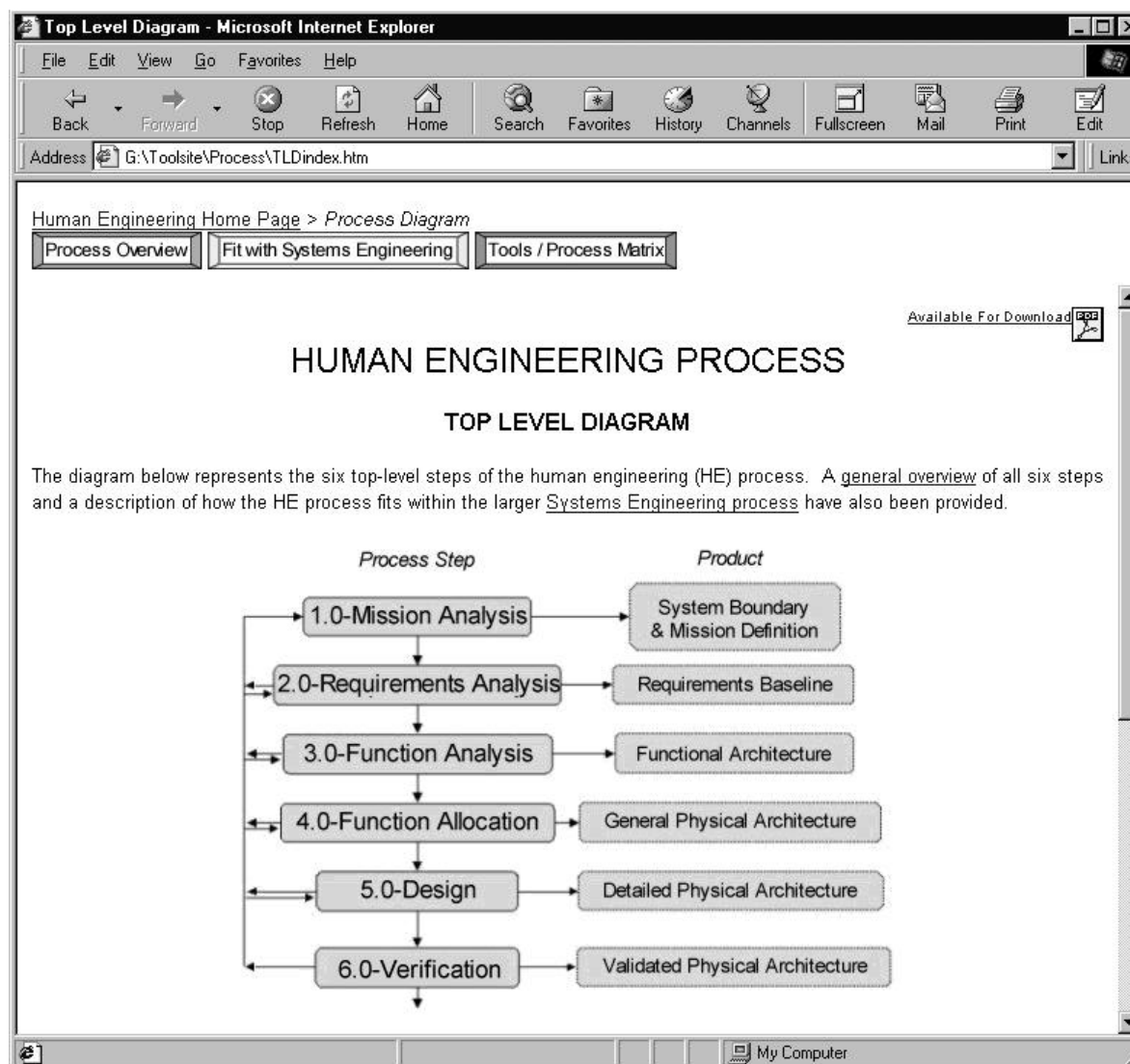
“An interdisciplinary collaborative approach to derive, evolve, and verify a life-cycle balanced system solution...”

- IEEE 1220-1998

- Account for the humans!
 - Design of *role*: Operator, maintainer, manager, analyzer, decision-maker, or supervisor
 - Design of *tasks*: minimize time, complexity, training; eliminate interface-specific tasks
 - Design of *interfaces*: improve communications, situation awareness, control
- Tasks and interfaces must be designed *concurrent* with the rest of the system
- System must be designed to adapt to changes in mission and evolution of tasks over time

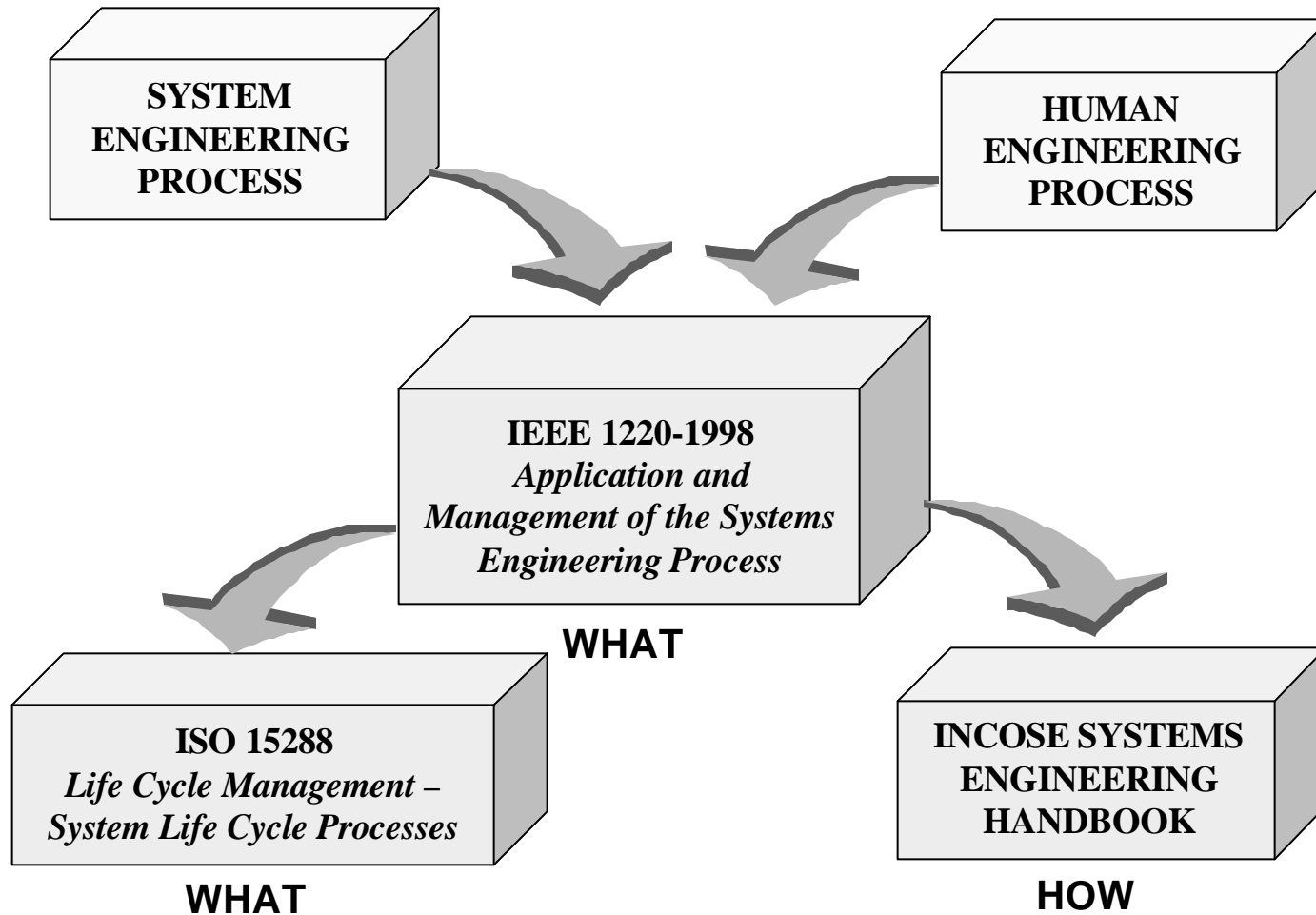


Progress: Define Human Engineering Process



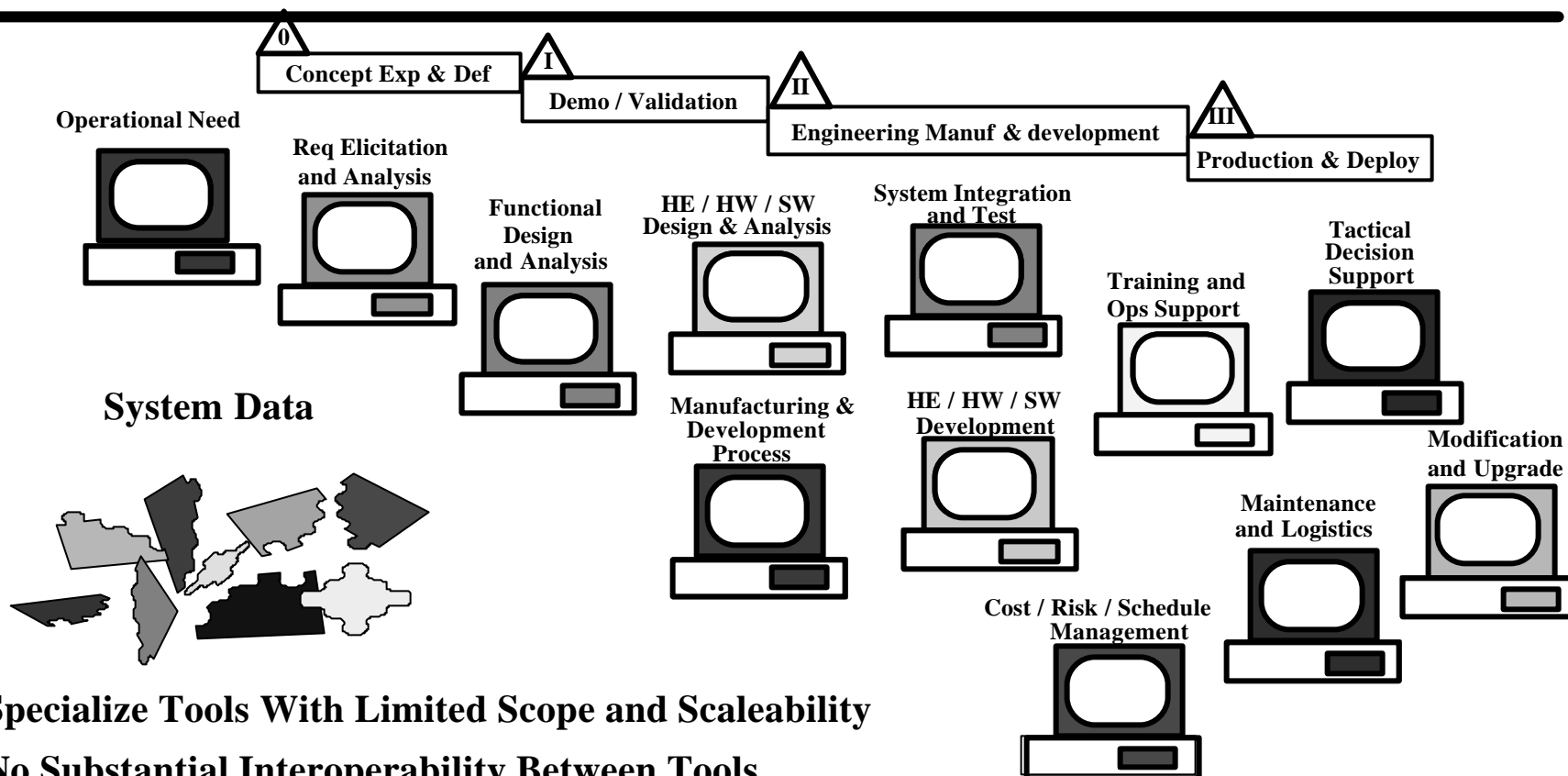


Progress: Incorporate He Process Into System Engineering Standards





Design Tools: Current Situation



- **Specialize Tools With Limited Scope and Scalability**
- **No Substantial Interoperability Between Tools**
- **Independent Data Bases**
- **Ad Hoc Configuration Management**

Today's Development Process Remains Largely Stovepiped!



HCDE Tool Interoperability Objective

Office Automation Circa 1985

Word / Word Perfect

Lotus 123 / dBase2

No Information Interchange

Office Automation Circa 1998

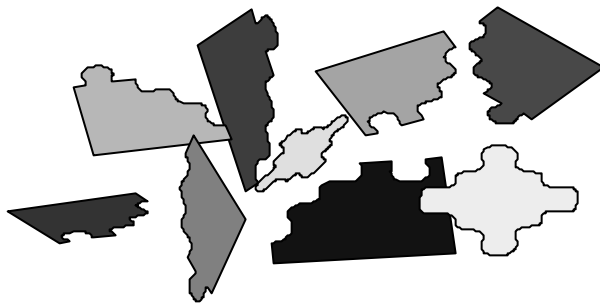
Standards Based Data Interchange

RTF / GIF / PDF

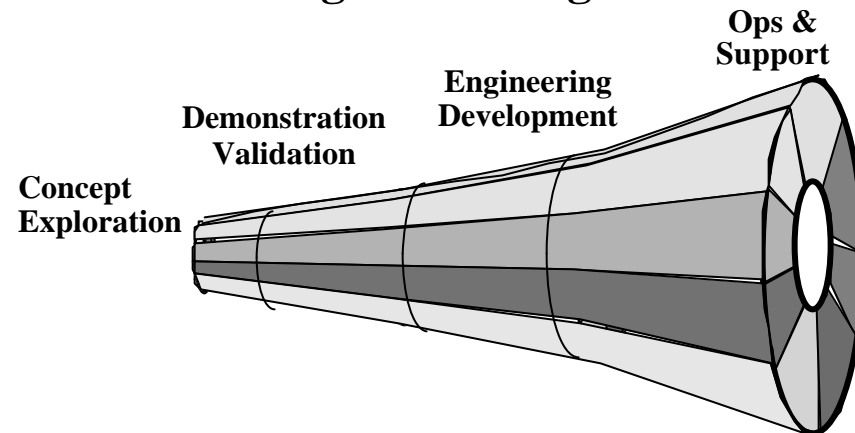
Extensive Information Interchange

Info Systems Engineering Today

System Data



Future Integrated Design Environment



- Extensible Templates for Data Exchange
- Common Tool Infrastructure Support Services for Collaborative Engineering

**COTS or
GFE Tools**

**Developed
under S&T
Program**

**Function Definition
(IMAGE)**



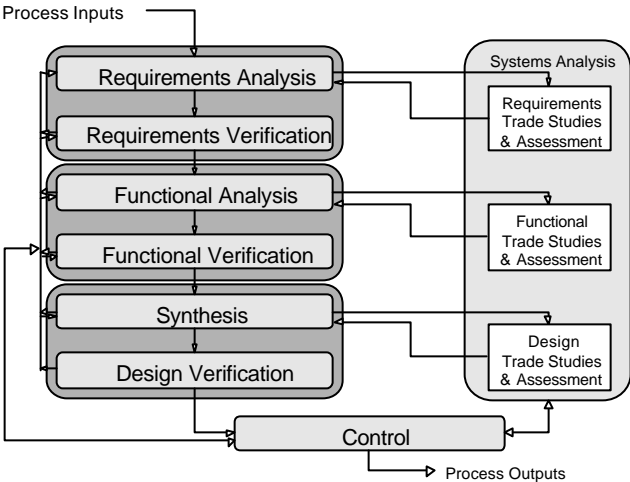
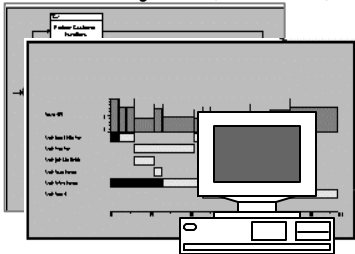
**System Requirements
Management (DOORS)**



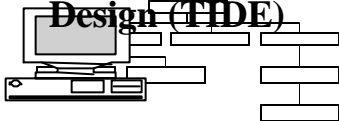
**Process Guidance
(HCDA)**



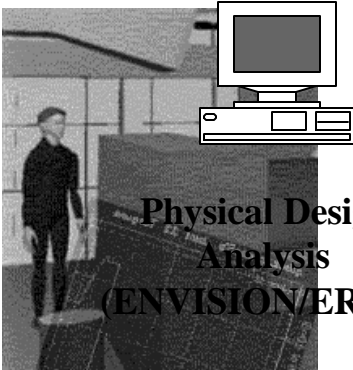
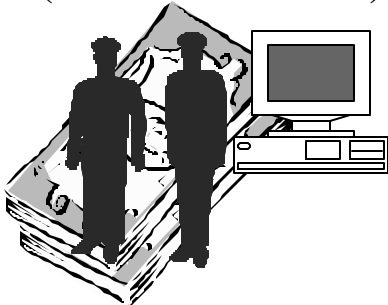
**System Function
Analysis (CORE)**



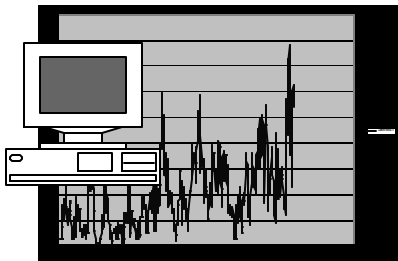
**Organizational
Design (TIDE)**



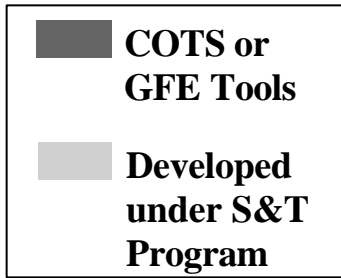
**Cost Analysis
(COMET/VAMOSC)**



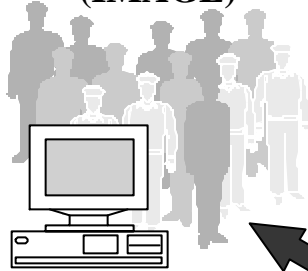
**Physical Design
Analysis
(ENVISION/ERGO)**



**Human Performance
Modeling (IPME)**



**Function Definition
(IMAGE)**



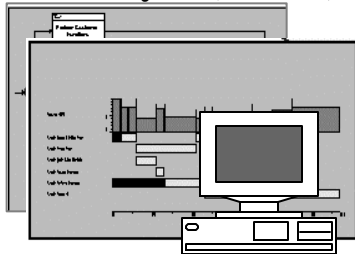
**System Requirements
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**Process Guidance
(HCDA)**



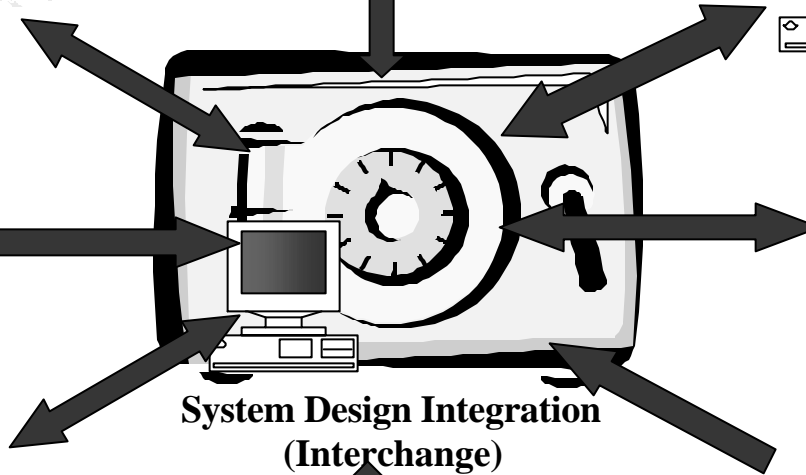
**System Function
Analysis (CORE)**



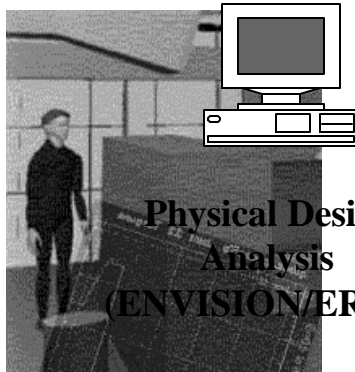
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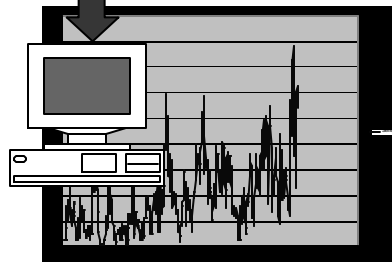
**System Design Integration
(Interchange)**



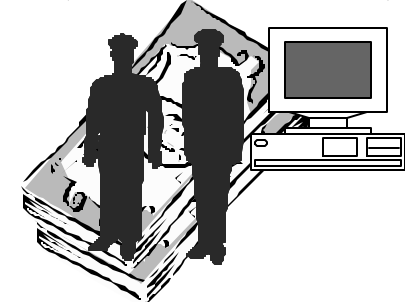
**Physical Design
Analysis
(ENVISION/ERGO)**



**Human Performance
Modeling (IPME)**



**Cost Analysis
(COMET/VAMOSC)**





Providing Human Factors Decision Support

Designer

Human-Centered
Design Advisor



*Human
Performance
Model*

capturing

*Human Factors
Knowledge*



Focused Advisors

- Executive Advisor (EA)
 - To provide advice to the engineering team that will lead to consideration of human issues early in system design.
 - insure that human related issues are adequately addressed throughout the systems engineering process



Executive Advisor Components

• Human Factors Engineering Database

Purpose:

- to provide design guidance from various sources related to human-system interaction areas
- to provide case studies showing the impact of design decisions on humans

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- ☐ Design Criteria Standard MIL-STD-1472F
- ☐ Situation Awareness Guidelines NAWCADPAX--96-268-TM
- ☒ All

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Human centered automation

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Automation and Supervisory Control

Human centered automation

Workload consideration

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Executive Advisor Components

- Context Sensitive Design Advisor

Purpose:

- to alert engineering team of potential human related problems/issues at all stages in system life cycle
- to provide design review questions and metrics related to these human problems/issues to ensure these issues are being addressed.



Executive Advisor Components

- Systems Engineering Process Advisor

Purpose:

- to provide Human Engineering techniques and analyses to help incorporate human inputs into system engineering activities
- to provide information about performing system engineering activities
- to ensure human considerations during systems engineering activities



Focused Advisors

- SEMP Advisor
 - monitors activity being carried out in project management tools
 - determines the potential impact of any changes on the planned human engineering activities.



Human Centered Design Advisor: Progress

- ✓ Develop Human Factors Guidelines Search Agent (SALSA)
- ✓ User testing
 - Add sets of guidelines & case studies
 - Build Decision Support System for human engineering process
- ✓ Develop EA Prototype
- ✓ User testing
 - SEMP